Trends of Hemoglobin Oximetry: Do They Help Predict Blood Transfusion During Trauma Patient Resuscitation?

Yang S(1), Hu PF, Anazodo A, Gao C, Chen H, Wade C, Hartsky L, Miller C, Imle C, Fang R, Mackenzie CF.

BACKGROUND: A noninvasive decision support tool for emergency transfusion would benefit triage and resuscitation. We tested whether 15 minutes of continuous pulse oximetry-derived hemoglobin measurements (SpHb) predict emergency blood transfusion better than conventional oximetry, vital signs, and invasive point-of-admission (POA) laboratory testing. We hypothesized that the trends in noninvasive SpHb features monitored for 15 minutes predict emergency transfusion better than pulse oximetry, shock index (SI = heart rate/systolic blood pressure), or routine POA laboratory measures.

METHODS: We enrolled direct trauma patient admissions ≥18 years with prehospital SI ≥0.62, collected vital signs (continuous SpHb and conventional pulse oximetry, heart rate, and blood pressure) for 15 minutes after admission, and recorded transfusion (packed red blood cells [pRBCs]) within 1 to 3, 1 to 6, and 1 to 12 hours of admission. One blood sample was drawn during the first 15 minutes. The laboratory Hb was compared with its corresponding SpHb reading for numerical, clinical, and prediction difference. Ten prediction models for transfusion, including combinations of prehospital vital signs, SpHb, conventional oximetry, and routine POA, were selected by stepwise logistic regression. Predictions were compared via area under the receiver operating characteristic curve by the DeLong method.

RESULTS: A total of 677 trauma patients were enrolled in the study. The prediction performance of the models, including POA laboratory values and SI (and the need for blood pressure), was better than those without POA values or SI. In predicting pRBC 1- to 3-hour transfusion, adding SpHb features (receiver operating characteristic curve [ROC] = 0.65; 95% confidence interval [CI], 0.53-0.77) does not improve ROC from the base model (ROC = 0.64; 95% CI, 0.52-0.76) with P = 0.48. Adding POA laboratory Hb features (ROC = 0.72; 95% CI, 0.60-0.84) also does not improve prediction performance (P = 0.18). Other POA laboratory testing predicted emergency blood use with ROC of 0.88 (95% CI, 0.81-0.96), significantly better than the use of SpHb (P = 0.00084) and laboratory Hb (P = 0.0068).

CONCLUSIONS: SpHb added no benefit over conventional oximetry to predict urgent pRBC transfusion for trauma patients. Both models containing POA laboratory test features performed better at predicting pRBC use than prehospital SI, the current best noninvasive vital signs transfusion predictor.